(a) the at least two spaced apart locations comprise first and second spaced apart locations, the first location being between the grating and the first substrate end and the second location being between the grating and the second substrate end; and

C3 (b) the device further comprises a bonding pad having a coefficient of expansion intermediate between that of the fiber and the substrate mounted between the optical fiber and the substrate at each of the first and second locations, the optical fiber being bonded to each bonding pad and each bonding pad being affixed to the substrate.

REMARKS

I. Status of Claims

In the January 22nd Office Action, the Examiner:

(1) allowed Claims 41-50;

(2) indicated in the body of the Office Action (see pages 2 and 6) that Claims 52 and 59 would be allowable if written in independent form;

(3) indicated in the Office Action Summary (PTO-326 form) that Claims 55 and 59 would be allowable if written in independent form; and

(4) rejected Claims 51-54, 56-58, and 60-61 under 35 USC §103.

By the above amendments, Claims 51 and 53 have been cancelled without prejudice, Claims 52, 55, and 59 have been written in independent form, and Claim 54 has been amended to more particularly define applicants' invention by making explicit that the negative expansion substrate provides thermal compensation to the grating.

The §103 rejections of the January 22nd Office Action were based on Kashyap et al., U.S. Patent No. 4,923,278 (the "Kashyap et al. patent") or

Chu et al., "Multilayer dielectric materials of $SiO_x/Ta_2O_3/SiO_2$ for temperature stable diode lasers," Materials Chemistry and Physics, Vol. 42, pages 214-216, 1995 (the "Chu et al. reference"). As the discussion to which we now turn shows, neither of these references discloses or suggests the subject matter of applicants' claims.

II. The Kashyap et al. Patent

The Kashyap et al. patent relates to the problem of variations in transmission delay through an optical waveguide and, in particular, to reducing the "temperature dependence of transmission delay in optical waveguides." (Kashyap et al. at column 1, lines 62-64.)

The patent has absolutely nothing to do with gratings. Recognizing this fact, the Examiner seeks to link the patent to gratings through the following passage which appears at column 6, lines 40-46, of Kashyap et al.:

> Optical fibres coated in accordance with the invention are expected to be useful in sensor applications. Also they would, for example, for the first time allow the construction of highly stable devices such as fibre external cavity single-mode lasers.

Based on this passage, the Examiner asserts:

> It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the well known techniques in order to provide a grating on the fiber of Kashyap et al between the two fixed location for the purpose of advantageously providing an efficient temperature sensor or a distributed feedback single mode laser, as claimed, if so desired. (1/22/01 Office Action at page 4.)

The problems with this assertion are that: (1) it is not based on what the Kashyap et al. patent discloses, and (2) it is not based on any suggestion in the art that Kashyap et al. should be modified to arrive at the present invention. Put simply, nowhere in the Kashyap et al. patent or anywhere else in the art is there any disclosure or suggestion regarding the use of a material having a negative coefficient of thermal expansion to provide thermal compensation to a grating.

When Kashyap et al. suggest that their fibers can be used in sensors or external cavity single-mode lasers, they are talking about their fibers per se, not fibers which have a grating.

Thus, at column 2, line 64, to column 3, line 15, Kashyap et al. explain that their sensors are of the interferometric type, wherein one fiber serves as a sensor fiber and another fiber serves as a reference fiber. As explained by Kashyap et al., for such a sensor, a "control element" needs to be "included in the reference arm to keep track of the drift induced by differential effects, especially when temperature is a noise source." By "de-sensitizing the optical delay in the fibre," Kashyap et al. seek to "overcome or at least mitigate" this problem. (Kashyap et al. at column 3, lines 6-15.)

At column 6, line 4, Kashyap et al. refer to their earlier UK patent applications 8305154 and 8306774 which discuss their sensors in more detail. A copy of UK Patent Publication No. GB 2 136 956 A, which claims priority from these UK patent applications, is attached as Exhibit B. As discussed therein, the sensor and reference fibers have mirrored ends which reflect light back to a photodetector 3, which is used to determine differences between transit times through the sensor and reference fibers interferometrically.

As explained in this patent publication:

> Owing to environmental effects, such as changes in temperature and acoustic noise, there is a random phase drift between the two arms [sensor and reference] giving rise to intensity fluctuations at the outputs. (GB 2 136 956 A at page 4, lines 37-41.)

The patent publication describes the use of an electronic locking procedure based on a feedback control loop to address this problem but ultimately admits that "[o]ccasionally, the interferometer would unlock as the total phase change induced by temperature fluctuations exceeded the available tracking range of the control loop...." (GB 2 136 956 A at page 4, lines 113-116.)

It is this problem, not a problem with a grating, that Kashyap et al. are concerned with when they suggest that their fibers can be used in "sensor applications." By "de-sensitizing the optical delay in the fibre with respect to changes in temperature," phase changes exceeding the available tracking range of their control loop would no longer occur.

Similar considerations apply to Kashyap et al.'s reference to fiber external cavity single-mode lasers. Like the interferometer of their UK patent publication, such lasers can employ fibers having mirrored ends. See, for example, Burrus, Jr. et al., U.S. Patent No. 4,528,670, at column 3, lines 42-43, (Exhibit C hereto), where external cavity lasers are "formed by coating one end of an optical fiber with reflective material...." As with the interferometer of the UK patent publication, such an external cavity laser will, in the words of the Kashyap et al. patent, benefit from "de-sensitizing the optical delay in the fibre with respect to changes in temperature."

Thus, as announced in the title of their patent, Kashyap et al. had the very specific goal of "temperature desensitization of delay in optical

fibres" and all of their disclosure is directed to this goal. As such, the reference has nothing to do with gratings. To modify the reference to include a grating requires some suggestion or incentive in the art to do so. The CAFC described this critical aspect of an obviousness analysis in ACS Hosp. Sys., Inc. v. Montefiore Hosp., 732 F.2d 1572, 1577, 221 USPQ 929, 932-933 (Fed. Cir. 1984), as follows:

> Turning now to the determination of obviousness under section 103, we conclude that none of the references, either alone or in combination, would have disclosed or suggested to one of ordinary skill in the art the use of override switching means in a television rental system. The trial court's heavy reliance on the widespread use of override switches appears to be no more than hindsight reconstruction of the claimed invention. The court below identified no source, other than the Sonnenberg patent itself, for the suggestion to use override switching means in a television rental system.
>
> Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. Under section 103, teachings of references can be combined only if there is some suggestion or incentive to do so. The prior art of record fails to provide any such suggestion or incentive. Accordingly, we hold that the court below erred as a matter of law in concluding that the claimed invention would have been obvious to one of ordinary skill in the art under section 103. (footnotes omitted; emphasis in original)

The January 22nd Office Action sets forth no such suggestion or incentive because: (1) there is no need to add a grating to Kashyap et al. to accomplish their goal of temperature desensitization of delay in optical

fibers, and (2) nowhere in the art, including Kashyap et al., is there any connection between a material having a negative coefficient of thermal expansion and a grating. Accordingly, applicants respectfully submit that the Examiner's §103 rejection based on the Kashyap et al. patent is unsound and should be withdrawn.

III. The Chu et al. Reference

In the rejection based on the Chu et al. reference, the Examiner stated that "Chu et al discloses an athermal waveguide device comprising a negative expansions substrate made of Ta_2O_5...."

Applicants acknowledge that Chu et al. teach that Ta_2O_5 has a "negative index-temperature coefficient," i.e., Chu et al. teach that $dn_{Ta2O5}/dT < 0$ (see, for example, Chu et al.'s Figure 1). However, the reference does not discuss the coefficient of thermal expansion (CTE) of Ta_2O_5. Accordingly, applicants respectfully submit that the Examiner has not established that Chu et al. disclose or in any way teach the use of a material having a negative CTE to achieve thermal compensation.

Accordingly, the rejection based on Chu et al. is unfounded and should be withdrawn.[1]

IV. Conclusion

Based on the foregoing, applicants believe that this application is now in condition for the declaration of an interference with Fleming et al., U.S. Patent No. 5,694,503. As set forth in their April 30, 1999 Response to

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[1] There are various further differences between applicants' claims and the references cited by the Examiner but in view of the fundamental distinctions discussed above, a detailed consideration of those differences at this point is not considered necessary.

As stated in footnote 1 of applicants' November 4, 1999 amendment, applicants' comments regarding the Chu et al. reference are made without prejudice to their right to show that Chu et al. is not prior art to them under any of the provisions of §102.

Restriction Requirement and Submission Under 37 CFR §1.607(a), applicants believe that the count in such an interference should be Claim 61 of this application, which reads:

Claim 61 -- Proposed Count

> In an apparatus having a fiber grating affixed to a device where the device provides thermal compensation to the fiber grating, the improvement wherein the device comprises a material having a negative coefficient of thermal expansion.

Reconsideration and the declaration of an interference based on this count are respectfully requested.[2]

Respectfully submitted,

Date: 7/6/01

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[2] No extension of time is believed to be necessary for the filing of this Amendment, but if such an extension of time is required, applicants request that this be considered a petition therefor. The Commissioner is hereby authorized to charge any fees which may be required for such an extension to Deposit Account No. 11-1158.

Also, if any claim fees beyond those submitted herewith are required for this Amendment, the Commissioner is hereby authorized to charge such fees to Deposit Account No. 11-1158.